Long-term influences of parental divorce on offspring affective disorders:

a systematic review and meta-analysis

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Abstract

Background: The prevalence of divorce in Western countries has increased in recent decades. However, there is no recent systematic review and/or meta-analysis of studies testing for long-term effects of parental divorce on offspring affective disorders. The present study conducted a systematic review and meta-analysis of studies published since 1980 testing for the association between parental divorce and offspring depression and anxiety in adulthood.

Method: PUBMED, Science Direct, Medline, PsychInfo, and PsychArticles databases were searched for eligible studies. Random-effect meta-analyses were used to synthesize effect sizes and to test whether associations of parental divorce with offspring affective disorders differ among three publication periods (i.e., before 1996, 1996-2005, 2006-2015).

Results: In total, 29 studies were eligible for the systematic review, and 18 studies were included in the meta-analyses (depression: *n*=21,581; anxiety: *n*=2,472)**.** There was significant association between parental divorce and offspring depression (OR=1.56; 95%CI [1.31, 1.86]), but not anxiety (OR=1.16; 95%CI [0.98, 1.38]). The effect of parental divorce on offspring depression was not weaker in the reports published in more recent decades.

Limitations: There is limited research in relation to offspring anxiety in adulthood.

Conclusions: Parental divorce is associated with an increased risk of adult offspring depression, with no indication of the effect being weaker in recent publications.

Key words: depression; anxiety; childhood adversity; parental separation; lifespan

Introduction

Affective disorders, such as depression and anxiety, are the most prevalent mental health problems in both children and adults (Beaumont & Lofts, 2013; Merikangas et al., 2011). A multitude of research suggests that adverse childhood experiences are a major risk factor for the development of affective disorders (Chapman et al., 2004). Parental divorce is the most common type of childhood adversity, second only to family socio-economic disadvantage (Sacks, Murphy & Moore, 2014). Indeed, divorce prevalence rates have dramatically increased in recent decades. For example, in the UK, the estimated prevalence rate of divorce was 22% in 1972, but by 2012, it had increased to 42% (Office for National Statistics, 2012). In other Western countries, such as the USA, the estimated prevalence rate of divorce is similarly very high (43%) (National Center for Health Statistics, 2012). This means that a large number of children are at increased risk of negative consequences associated with parental divorce. Indeed, previous research (for example, see: Amato & Keith, 1991a; Reid & Crisafulli, 1990) has demonstrated that children whose parents have divorced have higher levels of emotional and behavioural problems, and lower academic achievement and social functioning than do children whose parents have not divorced (Lansford, 2009).

From a developmental perspective, it is extremely important to determine whether exposure to early adversity, such as parental divorce, shows effects later in life. Two meta-analyses published more than 25 years ago (Amato and Keith, 1991a; Reid and Crisafulli, 1990) posit that parental divorce is associated with a variety of negative consequences in adult offspring, including an increased risk of emotional problems. However, as noted above divorce rates have more than doubled in the last decades (Office for National Statistics, 2012). As divorce becomes more commonplace and it is associated with less stigma in a modern society, the negative associations between parental divorce and offspring mental health outcomes should have declined over time. However, few studies have examined

whether the associations have remained stable over time (Sigle-Rushton et al., 2005). Moreover, there is some evidence to suggest that although divorce and separation have become more common than they once were, the impact they have on mental health has not decreased (Lacey et al., 2012). Therefore, as more studies have been published in the last 25 years, it is possible to explore the effect of publication year on the long-term association between parental divorce and offspring mental health.

In addition, study quality is likely to have changed during this time, including study design, sample size and study settings, all of which can influence the association. However, whether these study-related characteristics affect the reported results is yet to be explored.

Finally, it remains unclear whether the effects of parental divorce can differ for males and females. Some studies have shown that whilst male children of divorce demonstrate higher rates of externalizing problems in childhood and adulthood, female children of divorce demonstrate higher rates of internalizing problems which usually only emerge in early adulthood (Rodgers, 1994; Wauterickx et al., 2006). Some studies have also suggested that boys are more vulnerable to the short-term effects of childhood parental divorce (Hetherington et al., 1997), whereas females are more vulnerable to the long-term effects, such as in late adolescence and early adulthood (Rodgers, 1994).

The present study aimed to conduct a systematic review and meta-analysis of studies published between 1980 and 2015. First, we explored the association between parental divorce in childhood and affective disorders, such as depression and anxiety, in adult offspring. Second, we tested whether the association differed for publications at different time periods and for studies of different quality, sample size and settings. Finally, we explored a possible moderation effect of sex of offspring on this association.

Method

Study Selection

The review was conducted in accordance with the MOOSE (Meta-analysis Of Observational Studies in Epidemiology) guidelines (Stroup et al., 2000) and was approved by the University of Sussex School of Psychology Research Ethics Committee. Studies examining the relationship between parental separation in childhood and adult affective disorders were identified through searches of five databases: PUBMED, Science Direct, Medline, PsychInfo and PsychArticles. Search terms were as following: (*parent* divorc* OR parent* separation) AND (depress* OR anxi* OR emotion* OR affect* OR disorder)*. Pilot searches were conducted in order to test the sensitivity and specificity of the search terms. Reference lists and citations of eligible articles were examined for identification of any eligible study not previously located through the database search.

Inclusion and Exclusion Criteria

A number of inclusion and exclusion criteria were identified. First, studies were required to satisfy general inclusion criteria: papers were required to be an original empirical study, published in a peer-reviewed journal, written in English, published between 1980 and 2015 and to use human participants. At this stage, other meta-analyses and reviews, and papers utilising animal models were excluded. Second, studies were required to satisfy design criteria: cross-sectional, case-control or prospective cohort design studies were included. Studies measuring treatment or intervention effects were excluded. Third, studies were required to satisfy outcome variable criteria: those with clinical diagnostic or symptom measurement of affective disorder after the age of 18 years were included. Diagnostic outcomes included: unipolar depressive episode, major depression, generalized anxiety disorder, panic disorder, phobias, social anxiety disorder, post-traumatic stress disorder, obsessive-compulsive disorder, or health anxiety based on Diagnostic and Statistical Manual

of Mental Disorders, Research Diagnostic Criteria, International Classification of Diseases, or other psychiatric or psychological evaluations. Dimensional outcomes of depression or anxiety on standardized scales were also eligible. Studies including any other co-morbid psychiatric disorders or symptoms were excluded. Studies that focused solely on bipolar disorder were also excluded due to the phases of mania characteristic of this disorder which can often include symptoms of psychosis (National Health Service, 2013). Lastly, studies were required to satisfy predictor variable inclusion criteria: parental separation was defined as parental divorce or relationship separation, and studies were required to report on parental separation before the age of 16 years. Studies that focused on parental death, parental incarceration or adoption were excluded.

Data Extraction

Data were extracted from eligible studies collected for the systematic review using a meta-analysis coding frame; author, year, sample information and results were extracted. The quality of each study was assessed using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (Elm et al., 2007). For each section of a paper, a score (1 'meets the criteria' or 0 'does not meet the criteria") was given. A total score sum and percentage was calculated for each paper. Using the calculated mean of the STROBE score as a threshold, a binary variable indicating high or low quality of studies was created.

All regression coefficients were converted to odds ratios (ORs) using an online antilogarithm calculator: *http://ncalculators.com/number-conversion/anti-log-logarithm-calculator.htm.* Logarithms of beta values were calculated to produce the ORs, and logarithms of the beta values +/- (standard error * 1.96) were calculated to produce 95% confidence intervals. The values reflected the probability of presenting affective disorder adulthood, with odds ratios over 1 reflecting a greater likelihood. When available, effect sizes

for total sample, and males and females separately, were recorded. Effect sizes for depression and anxiety outcomes were analysed separately. Since significance testing requires that effect sizes are independent, only one effect size per sample for each affective disorder type was included. Effect sizes were synthesised using the log odd ratios (LORs), and were weighted using the inverse of their variance. LORs were then exponentiated (re-converted to odd ratios) for ease of interpretation. In studies that reported effect sizes for both unadjusted and adjusted (for covariates) models, results from adjusted models were included in the meta-analysis.

Statistical Analysis

The meta-analyses were conducted in R Studio version 3.2, 2015 (R Core Team, 2015). Random-effects models were fitted using the Metaphor package (Viechtbauer, 2010); random effects models assume that effect size variance can be explained by both systematic and random components (Lipsey & Wilson, 2001). Analyses were conducted for depression or anxiety separately.

Random-effects models meta-regressions were conducted to investigate effects of potential moderators. Gender (males versus females), sample size (small versus large), study quality (low versus high), study setting (community versus school), and publication year (before 1996, 1996-2005, 2006-2015) were investigated as potential moderators for the association between parental divorce and adult affective problems in offspring. For analysis examining the effect of study quality, a binary variable was created using the mean STROBE score in order to differentiate high and low quality studies. Similarly, for testing the effect of sample size, a binary variable using the mean sample size as a threshold to differentiate small and large sample sizes was created.

Regression analyses to test funnel plot asymmetry by Egger et al. (1997) were conducted, and trim fill funnel plots were created in order to test for publication bias.

Results

The study selection procedure is shown in Figure 1. The search resulted in 2986 papers, titles and abstracts of which were screened; 2877 papers were excluded at this point. Two researchers independently screened abstracts of 10% of the identified papers (k = 22), with 93% agreement rate, and consensus was reached regarding any inconsistencies. The full texts of remaining 109 papers were then screened, and a further 80 papers were excluded. Two researchers independently screened 10% of full texts of these papers (k = 10), achieving an agreement rate of >80%, and consensus was reached regarding any inconsistencies. Of the 29 remaining papers, reference lists were scanned for other relevant titles; however, no further papers were identified. Therefore, 29 studies were eligible for systematic review (Table 1). Eleven out of the 29 papers eligible for systematic review did not provide sufficient statistical information, and therefore 18 papers were included in the meta-analysis (depression: n=21,581; anxiety: n=2,472). All eligible studies achieved at least 60% on the STROBE checklist (with the maximum, median and mean scores as 94%, 80% and 77%, respectively).

Figure 1 here

All of the eligible studies measured depression and six studies measured anxiety. All studies were conducted in Western countries, with the USA representing the largest proportion of papers (k = 20). Sixteen studies (Barkley & Procidano, 1990; Garbadi & Rosen, 1991; Ge, Natsuaki & Conger, 2006; Gilman et al., 2003; Higgins et al., 2003; Hovens et al., 2010; Mack, 2001; Maier & Lachman, 2000; McCabe, 1997; McCleod, 1991; Nomura et al., 2002; Oakley et al., 1995; Pelkonen et al., 2008; Richardson & McCabe, 2001; Roubinov & Luecken, 2001; Wauterickx et al., 2006) reported sex of participants (with an average of 60% female). Five studies (Higgins et al., 2003; Mack, 2001; McCabe, 1997; Schilling, Aseletine

& Gore, 2007; Uphold-Carrier & Utz, 2012) reported age at which divorce occurred, with an average age of 7.8 years. Seventeen studies (Chase-Lansdale, Cherlin & Kieran, 1995; Garbadi & Rosen, 1991; Ge et al, 2006; Gilman et al., 2003; Higgins et al., 2003; Kendler et al., 1992; Mack, 2001; Maier & Lachman, 2000; McCabe, 1997; Nomura et al., 2002; Palosaari & Aro, 1994; Pelkonen et al., 2008; Richardson & McCabe, 2001; Rodgers, 1994; Summers et al., 1998; Uphold-Carrier & Utz, 2012; Wauterickx et al., 2006) reported age at which affective disorders were measured, with a range of between 18.9 years and 46.4 years, and with a mean of 31.3 years. The follow-up range in the prospective studies ranged from 2 years (Schilling et al., 2007) to 43 years (Rodgers et al., 1994), and average length of follow up period was 14.8 years. All studies apart from one used self-report measures of depression and anxiety, and one (Hovens et al. 2010) used a diagnostic interview.

There were ten cross-sectional studies, nine case-control studies and ten prospective studies. We have analysed the quality of studies by study design for all the eligible studies. Ten cross-sectional studies presented a range of STROBE scores from 62% (Higgins et al., 2003) to 93% (Kessler et al., 1997) (mean = 80%). Nine case-control studies presented a range of STROBE scores from 63% (Gabardi & Rosen, 1991) to 81% (Nomura et al., 2002; Summers at al., 2002) (mean = 74%). Ten perspective studies that were assessed for STROBE presented a range of STROBE scores from 68% (Gilman et al., 2003) to 94% (Pelkonen et al., 2008) (mean = 84%). A one-way ANOVA revealed significant differences in quality among designs (p = .04).

Below, we present a narrative analysis of all eligible studies. The results of systematic review are presented by outcome measure (depression, anxiety) and within each outcome measure by study design: cross-sectional studies, case-control studies and prospective studies. The results of the meta-analyses are presented at the end of each section and based on the studies for which the effect sizes were reported.

Table 1 here

Depression

Cross-sectional studies. Ten cross-sectional studies measured depression. Eight studies (Chase-Lansdale et al., 1995; Higgins, 2003; Kessler, Davis & Kendler, 1997; Kessler & Magee, 1993; Mack, 2001; Maier & Lachman, 2000; McLeod, 1991; Ross & Mirowsky, 1999) reported a significant association between parental divorce in childhood and offspring depression in adulthood, after controlling for socio-demographic factors. Two studies (Oakley et al., 1995; Landerman, George & Blazer, 1991) did not find a significant association. Five cross-sectional studies reported sex of participants, and two studies reported sex-specific effects for the association: Maier and Lachman (2000) reported higher levels of depression in men in comparison with women, whereas McCleod (1991) found higher levels of depression in women than in men.

Case-control studies. Nine case-control studies measured depression. Four studies (Barkeley & Procidano, 1990; Hovens et al., 2010; Richardson & McCabe, 2001; Summers et al., 1998) reported no significant differences in adult depression between offspring of childhood parental divorce and those from intact families. Five studies (Garbadi & Rosen, 1991; McCabe, 1997; Nomura et al., 2002; Roubinov & Luecken, 2001; Short, 2002), however, reported significant association between childhood parental divorce and offspring depression in adulthood. Seven of the case-control studies tested for associations in men and women (Barkley & Procidano, 1990; Gabardi & Rosen, 1991; Hovens et al., 2010; McCabe, 1997; Nomura et al., 2002; Richardson & McCabe, 2001; Roubinov & Luecken, 2001). One study (McCabe, 1997) reported a sex-specific association: women who experienced

childhood parental divorce had higher levels of depression than women from intact families did, but no effect was observed in men.

Prospective studies. Ten prospective studies of depression were eligible. Two studies did not find a significant association between childhood parental divorce and adult depression in offspring (Schilling et al., 2007; Aro & Palosaari, 1992). Seven studies reported a significant association (Furstenberg & Teitler, 1994; Gilman et al., 2003; Kendler et al., 1992; Pelkonen et al., 2008; Rodgers, 1994; Uphold-Carrier & Utz, 2012; Wauterickx et al., 2006). Two studies reported a stronger association between parental divorce and adult depression in female offspring (Pelkonen et al., 2008; Rogers, 1994). Two study reported a higher risk of depression in male adult offspring (Ge et al., 2006; Furstenberg & Teitler, 1994), and one study reported no significant sex differences (Wauterickx et al., 2006).

A meta-analysis of 22 effect sizes across 17 studies (n = 21,581) demonstrated that parental divorce was significantly associated with adult depression in offspring (OR = 1.56; 95%CI [1.31, 1.86], $p < .001$; Figure 2).

Figure 2 here

Heterogeneity analysis (Q test) indicated that effect sizes were heterogeneous, Q_T = 546.74, $p < .001$, compared with a critical value of χ^2 (21) = 32.67. There were no significant moderation effects of gender (males versus females), sample size (low versus high; based on the mean size of 1381), or study setting (school versus community) on the association between parental divorce and depression in adult offspring (Table 2). Study quality (low versus high) and publication year (<1996, 1996-2005, 2006-2015) significantly moderated the association between parental divorce and depression in later life (Table 2). Subsequent sub-analyses were carries out in order to compare data from studies of low and high quality,

and from those published in different time periods (Table 3). A sub-analysis for low and high quality studies revealed that the effect was higher for low quality studies (OR = 1.89; 95%CI [1.22; 2.92]) than for high quality studies (OR = 1.34; 95%CI [1.18; 1.52]).

Sub-group analyses according to the year of publication (before 1996, 1996 – 2005, 2006 – 2015) were conducted for depression studies (Table 3). A meta-analysis of studies published between before 1996 demonstrated that parental divorce was significantly associated with adult depression in adult offspring (OR = 1.27; 95% CI [1.18, 1.52]). A meta-analysis of studies published between 1996-2005 demonstrated that parental divorce was significantly associated with adult depression in offspring (OR = 1.76; 95% CI [1.16, 2.67]). A meta-analysis of studies published between 2006-2015 demonstrated that parental divorce was significantly associated with adult depression in offspring (OR = 1.67; 95% CI [1.31, 2.13]). Therefore, the effect of parental divorce was stronger for studies published between 1996-2005 than for those published before 1996 ($p < .05$). There were no significant differences in the effects between other publication periods (Table 2).

Tables 2 and 3 here

The difference in the effect sizes between two publication periods (before 1996 and 1996-2005) was not attributed to differences in the quality of studies published in these two periods (M = 79.00 for before 1996, and M = 72.30 for 1996-2005). There was a significant difference between the mean study quality for papers published in 1996-2005 (M = 72.30) and those published in 2006-2015 (M = 89.20) (overall difference between three periods: $F(2, 21) = 16.94$, $p < .001$).

Regression tests demonstrated non-significant funnel plot asymmetry for depression studies, providing no evidence for publication bias. This was confirmed by a trim and fill funnel plot (Figure 4a).

Anxiety

There were no cross-sectional studies of anxiety. Three case-control studies measured anxiety, with two studies reporting a significant association between childhood parental divorce and adulthood anxiety in offspring (Richardson & McCabe, 2001; Short, 2002), and one study reporting no significant association (Hovens et al., 2010). Only one prospective study measured anxiety (Kendler et al., 1992) and reported an increased risk of generalised anxiety disorder, panic disorder and specific phobias in adult offspring of children of parental divorce.

A meta-analysis of four effect sizes from four studies (n = 2,472) demonstrated that parental divorce was not significantly associated with anxiety in adult offspring (OR = 1.16; 95% CI [0.98, 1.38]; p = .08; Figure 3).

Figure 3 here

Heterogeneity analysis indicated that effect sizes were homogeneous, Q_T = 0.35, p < .95, compared with a critical value of χ^2 (3) = 7.82. Due to the small number of studies investigating anxiety as an outcome, the moderation effects were nor tested. Regression tests demonstrated non-significant funnel plot asymmetry for anxiety studies, providing no evidence of publication bias. This was confirmed by a trim and fill funnel plot (Figure 4b).

Figure 4 here

Discussion

The present systematic review and meta-analysis provided evidence for the long-term effect of parental divorce on offspring depression. We did not find any evidence that this association has decreased over time, based on the year of publication. In contrast to depression, our results showed that the association between parental divorce and adult offspring anxiety was not significant.

Limitations

A number of methodological limitations of the existing studies included in the systematic review and meta-analysis should be noted. Many of the eligible studies included in the present review relied on self-reported measures of depression and anxiety, rather than clinical diagnoses; the validity of self-report data regarding psychological well-being has been criticised. For example, Boyle (2015) questions whether depression scales measure trait level of depression or depressive syndrome itself. Besides, the majority of included studies used general population samples in school or community settings. The association between parental divorce and depression or anxiety in offspring may be stronger in clinical samples than in general populations. Moreover, the eligible studies varied in quality and the association with adult depression appeared to be stronger in studies of lower quality.

Our finding of the lack of association with adult anxiety needs to be interpreted with caution, because a total sample size of all anxiety studies available for the meta-analysis was very small (n = 2,472). Since only four studies on anxiety were available, we were not able to test for the moderation effects in these studies. Moreover, three of the four anxiety studies were case-control, and therefore used measures of anxiety available at one time point; therefore, the information on the onset and persistence of anxiety disorders was not available in these studies.

Given the retrospective nature of most of the existing studies, they did not allow to control for the onset and persistence of affective disorders. It is possible that the associations between parental divorce and mental health emerge in childhood and track to adulthood. The majority of mental health problems have onset in early life, with 50% of individuals presenting symptoms by the age of 14 years (Kessler et al., 2007). However, many individuals with early onset affective symptoms do not develop recurrent problems, whereas others have repeated affective symptoms across the life course (Musliner, Munk-Olsen, Eaton, & Zandi, 2016). Taking into account the heterogeneity in the course of affective disorders, it is important to identify mental health trajectories based on the age of onset and recurrence across the life course, as opposed to using cross-sectional diagnoses at a single time point. This can be a critically important step in our understanding how parental divorce affects mental health across the lifespan. We believe that the present review provides a strong rationale for conducting more research in the field using more rigorous methodological approaches.

Plausible pathways and mechanisms

There are several possible explanations for the observed long-term effects of parental divorce on offspring depression. First, attachment theory (Bowlby, 1969) suggests that separation from an attachment figure, often experienced as a result of divorce, could increase the risk of insecure attachment in offspring which has been linked to increased levels of depression in both childhood (Greenberg, Cicchetti & Cummings, 1993) and adulthood (Mickelson, Kessler & Shaver, 1997). Second, divorce often leads to economic disadvantage (Eggebeen & Lichter, 1991), and low childhood socio-economic status negatively affects psychological development and well-being. This negative effect of low childhood socio-economic status can persist throughout the life course, even amongst individuals who do not remain economically disadvantaged (Poulton et al., 2002), and can increase vulnerability to

adulthood depression (McLeod & Shanahan, 1993). Moreover, it is possible that features of the family environment correlated with divorce rather than divorce per se are the true causal risk factors for offspring mental health problems (McLanahan et al., 2013). For instance it has been suggested that parental conflict and negative interactions between parents, both before and after divorce, increase the likelihood of adult internalising problems in offspring (Schmidtgall et al., 2000).

It is equally plausible, that this link may (at least in part) reflect the effects of genetic factors shared by biologically related parents and children. Specifically, parents may provide genes to their biological offspring that increase both the risk of affective disorders and the corresponding risk of divorce exposure. This phenomenon is referred to as a passive gene-environment correlation (i.e., passive rGE) (Jaffee et al., 2012). Indeed, genetic transmission of risk following selection of more disorder-prone parents into divorce has attracted increasing attention in the literature on socio-emotional difficulties in offspring (Burt et al., 2008; D'Onofrio et al., 2005; Jaffee et al., 2012). These studies utilize genetically informative designs (e.g., adoption or twin designs) in order to disentangle genetic and environmental influences from parents to children, and therefore, they can provide more robust evidence for the causal effect of parental divorce on offspring outcomes (Jaffee et al., 2012; Gaysina et al., 2013). For instance, a study using Children-of-Twins design (D'Onofrio et al., 2005) explored whether genetic or environmental factors related to the twin parent accounted for the association between parental divorce and offspring psychopathology. Their results suggest that environmental influences associated with divorce account for the higher rates of psychopathology. Similarly, Burt and colleagues (2008) examined 610 adoptive and biological families, comparing mean externalizing behaviour problems in adolescents aged between 10-18 years across divorced and intact adoptive and biological families; and across families with different timing of divorce (before or after birth of the child). They found that

the associations between parental divorce and child's behaviour problems were not consistently stronger in biological than in adoptive families, and that the associations were specific to divorces that had occurred during the children's lifetimes. These results again suggest environmental mediation. Although such findings are collectively consistent with an environmental influence of divorce on child psychopathology, additional research is needed to confirm this conclusion for long-term psychological outcomes, beyond the periods of childhood and adolescence.

It is also worth noting that effects of parental divorce can be modified by certain offspring's characteristics (e.g., genetic, temperamental, cognitive), and therefore some individuals exposed to parental separation may be more vulnerable to negative psychological outcome than others. Mechanisms of long-term vulnerability and resilience to parental divorce are the subject of future investigations.

Clinical Implications

Given the increased likelihood of affective disorders in adulthood following childhood parental divorce, the need for preventative interventions is paramount. Traditionally, theorists stipulate that preventative treatment in adolescence could prevent manifestation of affective disorders in adulthood (Kupfer, Frank & Perel, 1989). However, statistics suggest that only between 25% and 34% of children and adolescents with diagnosed internalising problems receive clinical treatment, and of those, many terminate treatment or fail to respond, typically because treatment is offered too late (Donovan & Spence, 2000). For this reason, it may be beneficial to present selective intervention programmes aimed at high-risk individuals, those from a background of parental divorce, earlier in childhood. If there are indeed environmentally-mediated long-term effects of parental divorce, as discussed above, more personalised prevention strategies with the focus on individual's vulnerability characteristics are needed. These vulnerability-focused selective interventions aim to improve

the resilience and coping strategies to prevent risk of emotional problems across the life course either by direct work with children of divorce, or indirectly by working with parents (Harrington & Clark, 1998). Such interventions could include educational programmes implemented by a clinician to at risk individuals, befriending schemes with volunteers or drop-in centres for divorced parents and their offspring. Not only does preventative intervention of affective disorders reduce costs in terms of later clinical treatment in adulthood but it may also reduce other societal costs that often results from such disorders, such as unemployment, welfare assistance and lost productivity (Donovan & Spence, 2000).

Conclusions

The current research demonstrates that childhood parental divorce increases the likelihood of depression in adult offspring. These results imply need for early preventative measures for children of divorce since they present higher risk of developing affective problems in adulthood. Further research should consider a wide range of family-related factors as well as offspring characteristics and adult experiences that may affect the association between parental divorce and emotional problems. More studies on offspring anxiety are also needed in order to make more robust conclusions in relation to long-term effects of parental divorce.

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Table 1. A summary of studies included in the systematic review and meta-analyses (in bold)

Authors (year)	Country	Sample size (% female)	Outcome Measure (Instrument)	Age at Time of Parental Divorce	Year of Assessment	Age (years) at Assessment (mean)	Type of assessment	Setting	Sample	Description of Study	Strobe
Cross-sectional studies											
Chase-Lansdale et al. (1995)	UK	10,353 (NA)	Depression (Malaise Inventory)		1981	(23)	Self-report	Community	General population	Adjusted variables : economic status, children's emotional school performance preceding marital dissolution	84%
Higgins et al. (2003)	Australia	133 (69%)	Depression and Anxiety (Beck Depression Inventory; Depressive Experiences Questionnaire)	3.26		18 - 82 (41.1)	Self-report	Community	General population		62%
Kessler & Magee (1993)	US	2867 (NA)	Depression (Diagnostic Interview Schedule III-A)		1989	23	Interview – not medical	Community	General population	Adjusted variables: age, sex, race	81%
Kessler, Davis & Kendler (1997)	US	5877 (NA)	Depression (DSM-III-R)	8.41	1990 - 1992	15 – 54 (30)		Community	General population	Adjusted variables: ages represented by each person-year, age at the time of interview, sex, race, childhood family	93%

									socioeconomic status, co-morbidity with other outcome disorders and other adversities Other diversities: within the sample, 2.8% had experienced more than one diversity	
Landerman et al. (1991)	US	3801 (NA)	Depression (DSM-III-R)	1980			Community	General population		77%
Mack (2001)	US	4341 (57%)	Depression (Center for Epidemiological Studies Depression Scale, CES-D)		17 - 73	Self-report	Community	General population	Adjusted variables: gender, age, race, years of education, marital status, employment status, income, childhood – mother's level of education, public assistance support, age at which diversity occurred, current parental health	77%
Maier & Lachman (2000)	US	2988 (51%)	Depression (Kessler & Mroczek's dichotomous diagnostic depression variable)		30 - 60 (46.43)	Self-report	Community	General population	Adjusted variable: age	74%

McCleod (1991)	US	1755 (50%)	Depression (Diagnostic Interview Schedule, SCL-90-R)		18 - 64	Self-report	Community	General population	Adjusted variable: current age, childhood parental SES	80%
Oakley et al. (1995)	New Zealand	777 (100%)	Depression (Beck Depression Inventory)		18 - 44	interview	Community	General population	Adjusted variables: "other factors"	77%
Ross & Mirowsky (1999)	US	2592 (NA)	Depression (Center for Epidemiological Studies Depression Scale, CES-D)		18 - 95	Self-report	Community	General population	Adjusted factors: sex, minority status, age, parental death, parental education	91%
Case-control studies										
Barkley & Procidano (1990)	US	58 (58%)	Depression (Beck Depression Inventory)	8.8	18 – 23 (19.4)	Self-report	School	General population		69%

Garbadi & Rosen (1991)	US	500 (50%)	Depression (Beck Depression Inventory)			(19.22)	Self-report	School	General population	Adjusted variables: sexual behavior, attitudes toward marriage, depression, self-esteem, general psychological functioning	63%
Hovens et al. (2010)	Netherlands	2981 (67%)	Depression and Anxiety (Composite International Diagnostic Interview DSM-IV)		2004 - 2007	18 – 65	Clinical diagnostics and self-report	Community	General population (n = 213), primary care setting (n = 1012), mental health care setting (n = 706)	Adjusted variables: age, sex, education, lifetime comorbidity Childhood mental health: those with lifelong disorders were excluded from the study	71%
McCabe (1997)	US	71 (54%)	Depression (Beck Depression Inventory)	10.1		18 - 22 (18.9)	Self-report	School	General population		67%
Nomura et al. (2002)	US	182 (47%)	Depression and Anxiety (NA)		1975, 1977, 1985	16 - 33	Self-report	Community	General population	Adjusted variables: age, sex, parental substance misuse Childhood mental health: only those with no history of psychological problems were included	81%

Richardson & McCabe (2001)	Australia	167 (87%)	Depression and Anxiety (Depression Anxiety Stress Scale, DASS)	18-25 (20)	Self-report	School	General population		77%
Roubinov & Luecken (2001)	US	126 (54%)	Depression (Beck Depression Inventory)	(19.55)	Self-report	School	General population	Adjusted variables: family conflict, coping style	77%
Short (2002)	US	241 (NA)	Depression and Anxiety (Symptom Checklist-90-R)	18 - 28	Self-report	School	General population		80%
Summers et al. (1998)	US	242 (NA)	Depression (Beck Depression Inventory)	18 - 22 (19.5)	Self-report	Community	General population	Adjusted variables: family SES during adolescence, age, gender	81%
Prospective studies									
Aro & Palosaari (1992)	Finland	1656 (NA)	Depression (Beck Depression Inventory)	(22)	Self-report	School	General population		83%

Furstenberg & Teitler (1994)	US	1146 (NA)	Depression (Diagnostic Scale)	1987	(23)	Self-report	Community	General population		83%
Ge et al (2006)	US	550 (53%)	Depression (Symptom Checklist- 90 R)	1999	22 – 24 (23)		Community	General population	Adjusted variable: household income, age at which adversity occurred	87%
Gilman et al. (2003)	US	1104 (48%)	Depression (Beck Depression Inventory; Depressive Experiences Questionnaire)	1996	18 – 39 (29)		Community	General population	Adjusted variables: family history of mental disorders prior to birth of child, maternal age at time of birth, age at depression onset	68%
Kendler et al. (1992)	US	2036 (NA)	Depression and Anxiety (DSM-III R)		17 - 55 (30.1)	Blind review by diagnostician	Community	General population	Adjusted variables: age of child at interview, socioeconomic status	87%
Pelkonen et al. (2008)	Finland	1262 (57%)	Depression (Beck Depression Inventory)		32	Self- report	School	General population	Adjusted variables: “mid-adolescent depression”	94%
Rodgers (1994)	UK	3262 (NA)	Depression (Present State Examination, PSE; Psychiatric Symptom	1982-1983	36		Community		Adjusted variables: socioeconomic status	79%

			Frequency, PSF)		1989-1990	43				
Schilling et al. (2007)	US	1093 (NA)	Depression (Center for Epidemiological Studies Depression Scale, CES-D)	8.1	1998 2000	16 - 20 18 - 22	School	General pop	Adjusted variables: gender, race/ethnicity, socioeconomic status	94%
Uphold-Carrier & Utz (2012)	US	2496 (NA)	Depression (Composite International Diagnostic Interview DSM-IV)		1995-1996 2004-2006	25 – 75 35 - 86	Community		Adjusted variables: sex, educational attainment, marital status, age	84%
Wauterickx et al. (2006)	Belgium	4727 (51%)	Depression (DSM-III-R)		1998	19 - 54	Community	General pop	Adjusted variables: age, current partner, divorce of in-laws, partner depression	78%

Table 2. Moderation analysis

Variable	***k***	***QM* (df)**	**Estimate (95%CI*)***	***se***	***z***	***Q*E (df)**
Gender: male/female	10	0.42 (1)	0.17 (-0.03; 0.69)	0.27	0.65	72.53 (8)***
Sample Size: low/high	22	0.43 (1)	-0.12 (-0.50; 0.25)	0.19	1.06	54.51 (20)***
Study Setting: school/community setting	22	0.82 (1)	-0.12 (-0.36; 0.13)	0.13	-0.91	698.02 (20)***
Study Quality: low/high	22	8.08 (1)	**0.31 (0.09; 0.51)****	2.84	0.10	651.75 (20)***
Publication Year[$]: <1996/1996-2005	22	4.56 (2)	**0.26 (0.02; 0.50)***	0.12	2.10	505.77 (19)***
<1996/2006-2015	22	4.56 (2)	0.19 (-0.09; 0.47)	0.14	1.32	505.77 (19)***
1996-2005/2006-2015	15	.03 (1)	-0.05 (-0.67; 0.56)	0.31	-0.17	44.65 (13)***

*$p < .05$; **$p < .01$; ***$p < .001$. Note. *k* = number of effect sizes; *QM* = Moderator test for heterogeneity; Estimate = estimate for ρ when transformed to Fisher's z is used as the dependent variable CI = confidence interval; *se* = standard error; *z* = z-value; *QE* = Model test for heterogeneity; [$] - a publication year variable was treated as categorical for the two comparisons with <1996 in the same model, whereas a different binary variable was created for a comparison between 1996-2005 and 2006-2015.

Table 3. Sub-analyses on study quality and publication year.

		K ***studies/effects***	**OR (95%CI*)***	***se***	***z*** **score**	***Q*** **test (df)** ***p*** **value**
Study Quality	low	11	1.89 (1.22; 2.92)**	.22	2.86	36.31 (10) $p < .001$
	high	11	1.34 (1.18; 1.52)***	.06	4.56	12.70 (10) $p = .24$
Publication Year	<1996	7	1.27 (1.11; 1.45)***	.07	3.54	5.02 (6) $p = .54$
	1996-2005	10	1.76 (1.16; 2.67)**	.21	2.64	40.22 (9) $p < .001$
	2006-2015	5	1.67 (1.31; 2.13)***	.12	4.17	4.43 (4) $p < .35$

*$p < .05$; **$p < .01$; ***$p < .001$.

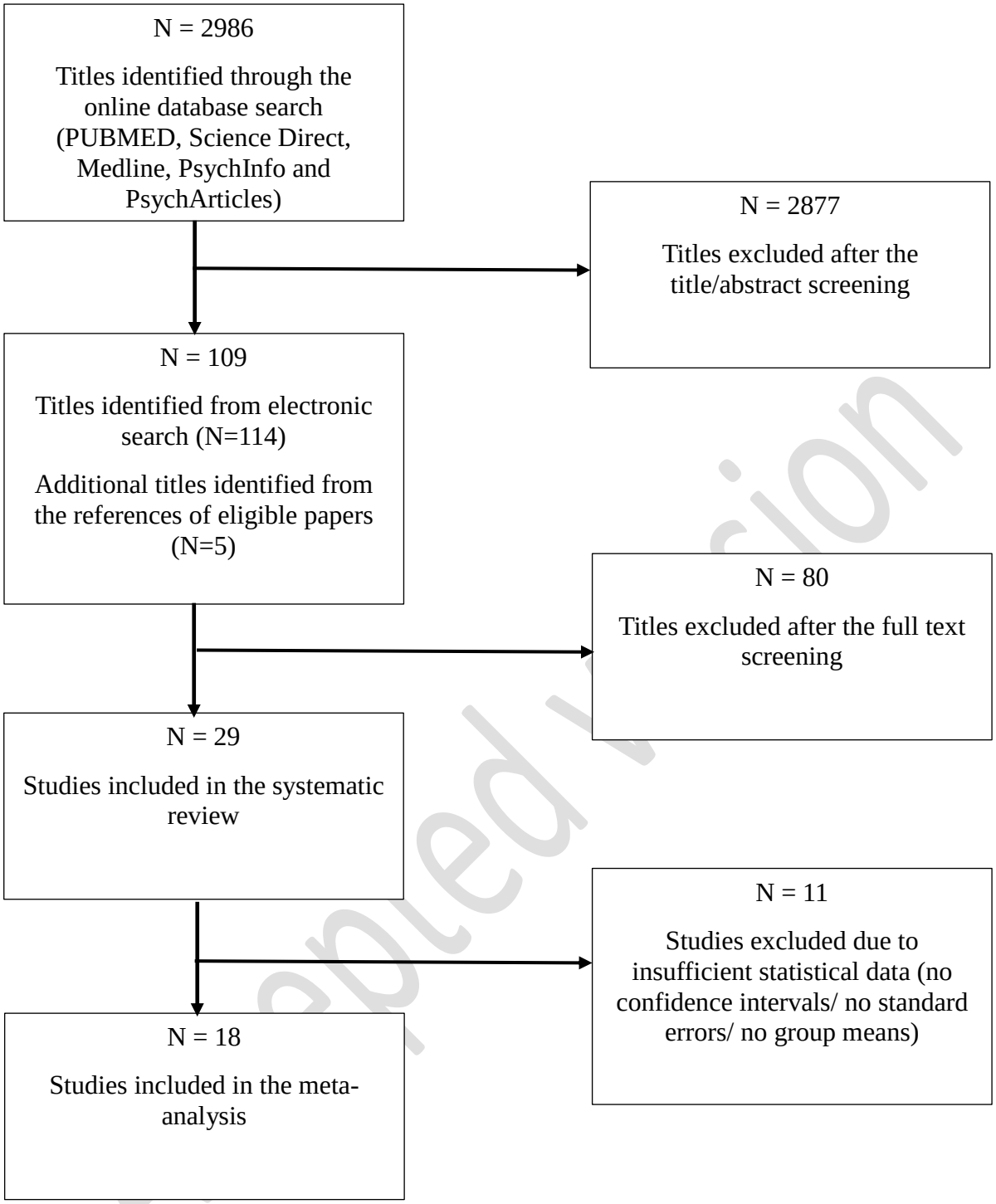

Figure 1. Flow-chart of the study selection procedure

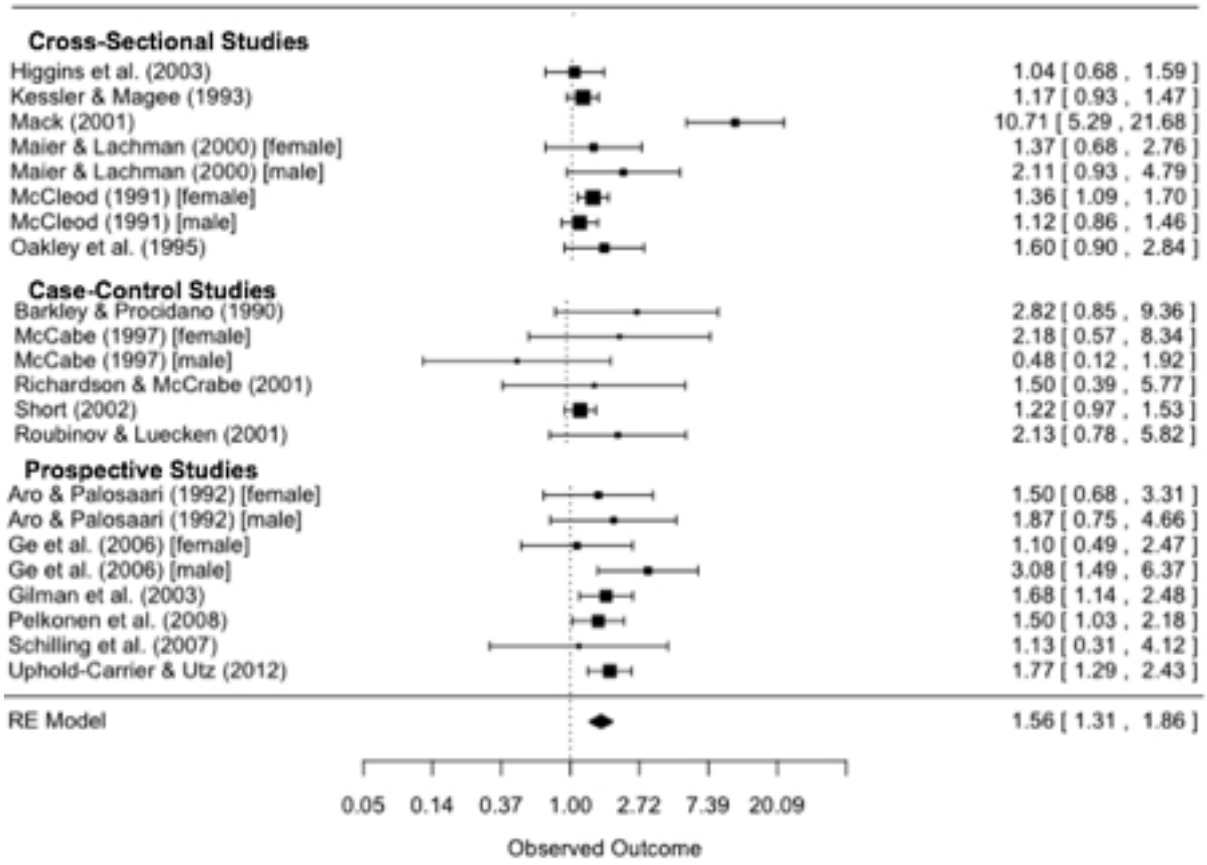

Figure 2. A forest plot of effect sizes (ORs) of parental divorce on offspring depression (k = 22; n = 21,581)

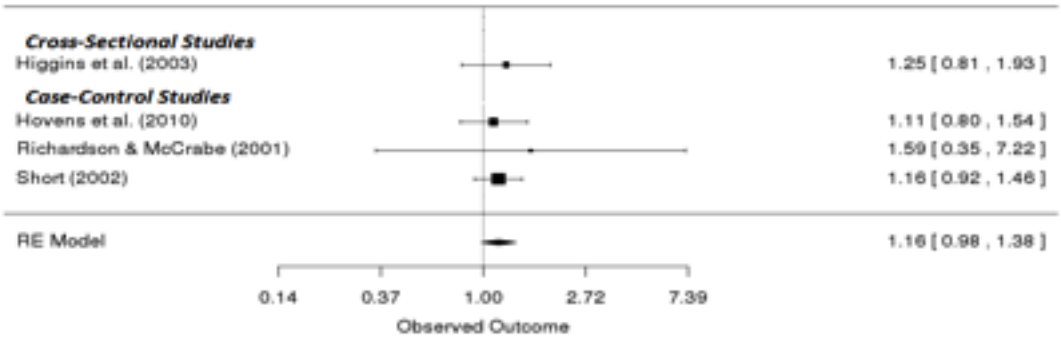

Figure 3. A forest plot of effect sizes (ORs) of parental divorce on offspring anxiety (k = 4, n = 2,472)

a. Depression studies *b. Anxiety studies*

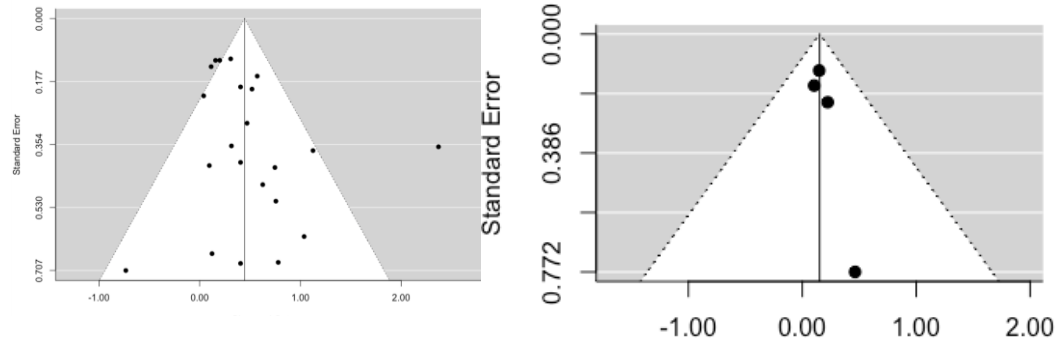

Figure 4. Trim fill funnel plots for: a) depression studies and b) anxiety studies included in the meta-analyses